

The New Main Injector and Recycler DCCT front-end: MIBEAM

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Over the current shutdown the Instrumentation Group has developed a new DCCT Front-end for the Main Injector and Recycler rings. This was deemed appropriate for two reasons. First since we were moving the Main Injector DCCT from MI-60 to MI-30 with the Recycler. The second reason is that we can now cover the entire range of all three readbacks of the current systems (I:IBEAMS, I:IBEAMM, and I:IBEAMB) with one device I:BEAM.

MIBEAM

The new system node, named MIBEAM will reside at MI-30 in relay rack RR30114. It consists of a VME five-slot crate with a Motorola MVME-2401 controller. The ADC is an Interactive Circuits and Systems (ICS) ICS-110BL-8B 24 bit, eight channel ADC that samples at 6.9 MHz and outputs a value, averaged over 128 samples, at 54 kHz. It has a dynamic range of 110 dB. We have measured in the lab the resolution to be 18.5 bits which agrees with the manufactures specifications. What this means is that this ADC has a resolution of about 50 μ Volts over a range of ± 5 Volts. The supporting cards consist of a PMC-UCD for input of TCLK signals, an IP-MDAT transmitter card on a carrier board for transmitting the MDAT data, and an MDAT fanout card for the same purpose. A picture of the setup can be seen below.



The two main new devices for this system are:

- I:BEAM in units of e12 particles.
- R:BEAM in units of e12 particles.

Also included for convenience are the aliases:

- I:BEAMS an alias of I:BEAM in units of e10 particles.
- R:BEAMS an alias of I:BEAM in units of e10 particles.

Each of the four devices cover the entire range and no further devices are required for the full range of beam intensities. The second two devices are simple database aliases provided for plotting convenience but do cover the same range as their originals. These four devices can be Fast Time Plotted and Snap Shot Plotted at up to 720 Hz rates.

Fixed-Event Devices

There are many new devices that record beam measurements on event. The first group is called the fixed-event devices. Each of these devices is an arrayed device that has 6 elements. The first element would measure beam intensity on the final injection event, the second at the start of ramp, etc.. For example, the device I:BEAM29[0-5] has a first element taken on the last \$1F before the start of ramp. The second element (I:BEAM29[1]) is the measure of intensity at the \$22 event, or start of ramp. The third element (I:BEAM29[2]) is the intensity measured on the \$25 event, or start of flattop. The fourth, fifth and sixth elements are taken during the transfer events and differ depending on the type of cycle. In Recycler the first element is the injection intensity and the second is the intensity measured if a sudden loss of beam occurs (\$F9 event). These device names are as follows:

For Main Injector:

- I:BEAM20[0-5]
- I:BEAM21[0-5]
- I:BEAM23[0-5]
- I:BEAM29[0-5]
- I:BEAM2A[0-5]
- I:BEAM2B[0-5]
- I:BEAM2D[0-5]
- I:BEAM2E[0-5]

For Recycler:

- R:BEAME0[0-5]
- R:BEAME1[0-5]
- R:BEAME2[0-5]
- R:BEAME3[0-5]
- R:BEAME4[0-5]
- R:BEAME7[0-5]

Variable-Event Devices

The second group of event triggered measurements is the variable-event devices. These devices have a TCLK trigger, a delay (measured in seconds) and an intensity readback. The TCLK event is set via the “Timer Reference” selection on a parameter page. The delay is the D/A setting and the intensity readback is the A/D reading. These devices have the following names.

For Main Injector

- I:BEAM1
- I:BEAM2
- I:BEAM3
- I:BEAM4
- I:BEAM5
- I:BEAM6
- I:BEAM7
- I:BEAM8
- I:BEAM9
- I:BEAM10

And for Recycler

- R:BEAM1
- R:BEAM2
- R:BEAM3
- R:BEAM4
- R:BEAM5
- R:BEAM6
- R:BEAM7
- R:BEAM8
- R:BEAM9
- R:BEAM10

All of the timed measurements can be Fast Time plotted up to a rate of 15 Hz.

MDAT

The MIBEAM front-end outputs and MDAT frame number 73. This will provide the intensity of the machine over 16 bits of data with a maximum intensity of 34.7 E12. The old MDAT frame numbers 60 and 61 will still be provided by Greg Vogel's hardware. This is due to the extremely important nature of frame number 60 in the working of the MDAT receivers around the entire accelerator complex.

Scale Factors and Offsets

While not settable from an ACNET console, the new Main Injector and Recycler DCCT readback's scale factors and offsets can be read and lumberjacked from a console. The names of these devices are I:BEAMSF and I:BEAMOF for Main Injector and R:BEAMSF and R:BEAMOF for Recycler. They can only be changed from the terminal connection to the front-end. The ACNET database scale factors and offsets for the devices I:BEAMXX and R:BEAMXX are 1 and 0 respectively. I:BEAMS and R:BEAMS have ACNET scale factors of 100 and 0. These scale factors were chosen to keep the SDA from reading data incorrectly every time an ACNET scale factor or offset is changed.

Old Devices

At startup the old devices I:IBEAMS, I:IBEAMM and I:IBEAMB as well as R:IBEAM, R:IBEAMW and R:IBEAMS will still be provided by MADC channels from MI30. This is to guarantee a smooth transition to the new system and to give reassurance to users of the new systems validity. In January, 2004 we will remove the current MADC channels and the database names associated with them. This should give ample time for people to switch to the new system in their daily work as well as their SDA tables. Any old sample and hold devices will not be provided at startup, or in the future.

Questions

If you have any questions about the new system, its capabilities, or its functionality please feel free to call me, Tom Meyer, at #5193 or email me at tsmeyer@fnal.gov. Jim Crisp, the project engineer, is also available for questions at #4460 and crisp@fnal.gov.